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Date: April 17, 2007/Jessica Sexton/
Jessica Sexton**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re patent application of:

Applicant(s): **Bhanwar Singh, *et al.***Examiner: **John S. Ruggles**Serial No: **10/768,515**Art Unit: **1756**Filing Date: **January 30, 2004**

Title: **USING SIDEWALL ABSORBER TO ENABLE THE PRINTING OF FINER
FEATURES IN NANOPRINT LITHOGRAPHY (1XMASK)**

**Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

APPEAL BRIEF

Dear Sir:

Applicant submits this brief in connection with an appeal of the above-identified patent application. Payment is being submitted via credit card in connection with all fees due regarding this appeal brief. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [AMDP999US].

I. Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in the present appeal is Advanced Micro Devices, Inc., the assignee of the present application.

II. Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

Claims 1-8 stand rejected by the Examiner. The rejection of claims 1-8 is being appealed.

IV. Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

The Examiner has entered the amendments submitted after the Final Office Action. (*See* Communication from Examiner dated Feb. 26, 2007).

V. Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))**A. Independent claim 1**

Independent claim 1 recites a mask comprising: a translucent substrate; one or more three-dimensional features comprising one or more vertical sidewalls; an absorbing material deposited upon one or more of the vertical sidewalls so that light in an incident direction to an upper surface of the substrate will be absorbed by the absorbing material, resulting in light blocking features; and one or more horizontal surfaces, formed upon one or more of the three-dimensional features, that allow light rays to exit a lower surface of the substrate unobstructed by the absorbing material. (*See e.g.*, Figures 1,2 and corresponding text at page 6, lines 15- page 7, line 9).

The aforementioned means for limitations are identified as claim elements subject to the provisions of 35 U.S.C. §112 ¶6. The corresponding structures are identified with reference to the specification and drawings in the parentheticals above corresponding to those

claim limitations.

VI. Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi))

A. Whether claims 1 and 3 are unpatentable under 35 U.S.C. §102(b) as being clearly anticipated by Vasudev *et al.* (WO 94/17450) or Vasudev *et al.* (US 5,411,824).

B. Whether claim 2 is unpatentable under 35 U.S.C. §102(b) as being anticipated by either of the Vasudev *et al.* documents in view of Grant *et al.*

C. Whether claims 4 and 8 are unpatentable under 35 U.S.C. §103(a) over either of the Vasudev *et al.* documents in view of Hashimoto (US 5,786,114).

D. Whether claim 5 is unpatentable under 35 U.S.C. §103(a) over either of the Vasudev *et al.* documents in view of Takemura (US 5,530,265) or French *et al.* (US 2006/0051974).

E. Whether claim 6 is unpatentable under 35 U.S.C. §103(a) over either of the Vasudev *et al.* documents in view of Aggas *et al.* (US 5,944,157) or Aggas *et al.* (US 6,020,590).

F. Whether claim 7 is unpatentable under 35 U.S.C. §103(a) over either of the Vasudev *et al.* documents in view of Yeh (US 2003/0193068).

VII. Argument (37 C.F.R. §41.37(c)(1)(vii))

A. Rejection of Claims 1 and 3 Under 35 U.S.C. §102(b)

Claims 1 and 3 stand rejected under 35 U.S.C. §102(b) as being clearly anticipated by Vasudev *et al.* (WO 94/17450) or Vasudev *et al.* (US 5,411,824). Reversal of this rejection is respectfully requested for at least the following reasons. Vasudev *et al.* does not disclose or suggest each and every limitation set forth in the subject claims.

A single prior art reference anticipates a patent claim only if it *expressly or inherently describes each and every limitation set forth in the patent claim*. *Trintec Industries, Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 63 USPQ2d 1597 (Fed. Cir. 2002); *See Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The *identical invention must be shown in as complete detail as is contained in the ... claim*. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989) (emphasis added).

Applicant's claimed invention relates to a *mask for a nanoprint lithographic process*. In particular, claim 1 recites a *translucent substrate with one or more three-dimensional features comprising one or more vertical sidewalls*. An absorbing material is deposited upon one or more of the vertical sidewalls so that *light in an incident direction to an upper surface of the substrate will be absorbed by the absorbing material, resulting in light blocking features*. One or more horizontal surfaces are formed upon one or more of the three-dimensional features that *allow light rays to exit a lower surface of the substrate unobstructed by the absorbing material*. The Vasudev *et al.* references do not disclose or suggest these novel aspects of the invention as claimed.

The two Vasudev *et al.* documents are counterpart documents relating to the same subject matter and will again henceforth be discussed together. Vasudev *et al.* relates to a phase shifting mask having absorbent sidewalls that reduce edge scattering and thereby improve resolution. Contrary to assertions in the Office Action, the cited document does not disclose the claimed aspects at col. 3, lines 36-41 or col. 4, lines 13-26, let alone anywhere else in the document. Rather, the first cited passage simply describes a prior art conventional phase shifting mask utilizing vertical trenches as phases shifters. The second cited passage states that the:

...mask 30 now includes a light absorbing or attenuating sidewall 31 *to address the scattering problem* noted with the prior art PSM 10 of FIGS. 1A-B. The absorbing/attenuating sidewall 31 is disposed along the vertical ("sidewall") portion of trench 12. The absorbing/attenuating sidewall 31 is formed from a conducting material in order to provide a conducting region to fully absorb or attenuate (partially absorb in order to attenuate) *light rays penetrating the sidewall*. (Emphasis added.)

It is readily apparent that the entirety of the disclosure of Vasudev *et al.* is concerned with preventing internal scattering of light within a phase mask. Additionally, the aforementioned passage continues at col. 4, line 37 to state that “it *prevents or inhibits total internal reflections* and especially for partially coherent illumination, *eliminates the ‘waveguiding’* effects by creating ‘lossy’ sidewalls which suppress resonances on the shifted regions.” This passage makes it clear that the Vasudev *et al.*’s sidewalls are only contemplated for absorbing or attenuating light internal to the phase mask. There is simply no disclosure or suggestion of blocking light *in an incident direction to an upper surface of the substrate* to result in *light blocking features* as claimed. The Final Action contends that the presently claimed “light blocking” features would be inherent in the structure of Vasudev *et al.*, further stating that “Applicants have recognized another advantage that would either inherently or naturally flow from following the teaching or suggestion of the prior art.” However, this contention is incorrect. With Vasudev *et al.* patterning is performed by using an “aerial image” that is projected through a phase shifting mask (PSM) onto a substrate, which improves the intensity of a projected image. The passage at col. 4, line 56 states very clearly that “without the absorbing/attenuating sidewall 31, the prior art PSM 10 results in the difference 42 of the two intensity profiles. This difference can degrade the resolution and/or the depth of focus of the aerial image as well as causing a nonuniformity of linewidth in the printed image.” It is therefore abundantly clear that Vasudev *et al.*’s sidewalls, while bearing a superficial similarity to structure of the claimed invention, are strictly disclosed as improving intensity of a patterned image projected from another source, and do not in themselves contribute in any way to the patterning. Thus, there is no way that Vasudev *et al.*’s sidewalls can be construed as inherently resulting in *light blocking features*, as recited in claim 1. Such an interpretation would lead away from the plain disclosure of this reference and would destroy the disclosed functionality of this device. Contrary to statements in the Final Action, the subject claims in fact clearly point to different structure that is not disclosed or suggested in the Vasudev *et al.* references. Consequently, the cited documents fail to disclose or suggest a mask having *an absorbing material deposited upon one or more of the vertical sidewalls so that light in an incident direction to an upper surface of the substrate will be absorbed by the absorbing material, resulting in light blocking features* and *one or more horizontal surfaces, formed upon one or more of the three-dimensional features, that allow light rays to exit a lower surface of the*

substrate unobstructed by the absorbing material, as recited in amended claim 1. For at least the foregoing reasons, it is readily apparent that the cited document does not disclose or suggest every aspect of the claimed subject matter. Accordingly, the rejection of independent claim 1 (and claims that depend there from) should be reversed.

B. Rejection of Claim 2 Under 35 U.S.C. §102(b)

Claim 2 stands rejected under 35 U.S.C. §102(b) as being clearly anticipated by either of the Vasudev *et al.* documents in view of Grant *et al.* Reversal of this rejection is respectfully requested for at least the following reasons. Claim 2 depends from independent claim 1. As stated *supra*, neither of the Vasudev *et al.* references disclose or suggest every limitation set forth in the subject independent claim. Even if Grant *et al.* could properly be relied upon as an evidentiary reference as stated in the Final Action, it does not cure the aforementioned deficiencies of the primary reference. Therefore, this rejection should be reversed.

C. Rejection of Claims 4 and 8 Under 35 U.S.C. §103(a)

Claims 4 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over either of the Vasudev *et al.* documents in view of Hashimoto (US 5,786,114). Reversal of this rejection is respectfully requested for at least the following reasons. As stated *supra*, neither of the Vasudev *et al.* documents disclose or suggest every limitation set forth in the subject independent claim 1. Therefore, claims 4 and 8, which depend therefrom, are allowable for at least the same reasons. Reversal of this rejection is therefore respectfully requested.

D. Rejection of Claim 5 Under 35 U.S.C. §103(a)

Claim 5 stands rejected under 35 U.S.C. §103(a) as being unpatentable over either of the Vasudev *et al.* documents in view of Takemura (US 5,530,265) or French *et al.* (US 2006/0051974). Reversal of this rejection is respectfully requested for at least the following reasons. Claim 5 depends from independent claim 1. As stated above, the Vasudev *et al.* documents fail to disclose or suggest every limitation set forth in the subject independent claim. Neither Takemura nor French *et al.* cure the aforementioned deficiencies of these base references. Therefore, this rejection should be reversed.

E. Rejection of Claim 6 Under 35 U.S.C. §103(a)

Claim 6 stands rejected under 35 U.S.C. §103(a) as being unpatentable over either of the Vasudev *et al.* documents in view of Aggas *et al.* (US 5,944,157) or Aggas *et al.* (US 6,020,590). Reversal of this rejection is respectfully requested for at least the following reasons. Claim 6 depends from independent claim 1, and as noted *supra*, the Vasudev *et al.* documents do not disclose or suggest every limitation set forth in the subject independent claim. Neither of the Aggas *et al.* documents make up for the deficiencies of the cited reference. For at least these reasons, this rejection should be reversed.

F. Rejection of Claim 7 Under 35 U.S.C. §103(a)

Claim 7 stands rejected under 35 U.S.C. §103(a) as being unpatentable over either of the Vasudev *et al.* documents in view of Yeh (US 2003/0193068). Reversal of this rejection is respectfully requested for at least the following reasons. Claim 7 depends from independent claim 1. The Vasudev *et al.* documents fail to disclose or suggest every limitation set forth in the subject independent claim, as stated *supra*. Yeh fails to cure the aforementioned deficiencies; thus, this rejection should be reversed.

VIII. Conclusion

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-8 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063 [AMDP999US].

Respectfully submitted,
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VIII. Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1. A mask comprising:
a translucent substrate;
one or more three-dimensional features comprising one or more vertical sidewalls;
an absorbing material deposited upon one or more of the vertical sidewalls so that light in an incident direction to an upper surface of the substrate will be absorbed by the absorbing material, resulting in light blocking features; and
one or more horizontal surfaces, formed upon one or more of the three-dimensional features, that allow light rays to exit a lower surface of the substrate unobstructed by the absorbing material.
2. The mask of claim 1, the translucent substrate comprising silicon dioxide.
3. The mask of claim 1, the translucent substrate being quartz.
4. The mask of claim 1, the absorbing material comprising SiON.
5. The mask of claim 1, the absorbing material comprising Si – rich nitride.
6. The mask of claim 1, the absorbing material comprising Si – rich oxide.
7. The mask of claim 1, the absorbing material comprising SiOCN.
8. The mask of claim 1, the absorbing material comprising TiN.
- 9-23 Cancelled.

IX. Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

None.

X. Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

None.